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1) Applicant *(for all designated States except US)*: COURTAULDS ENGINEERING LIMITED [GB/GB]; P.O. Box 11, 256 Foleshill Road, Coventry, West Midlands CV6 5AB (GB).

2) Inventor; and
5) Inventor/Applicant *(for US only)*: DEEMING, Robert, Michael [GB/GB]; 23 Hayle Close, Nuneaton, Warwickshire CV11 6FE (GB).

4) Agent: NEWBY, Martin, John; J.Y. & G.W. Johnson, Furnival House, 14-18 High Holborn, London WC1V 6DE (GB).

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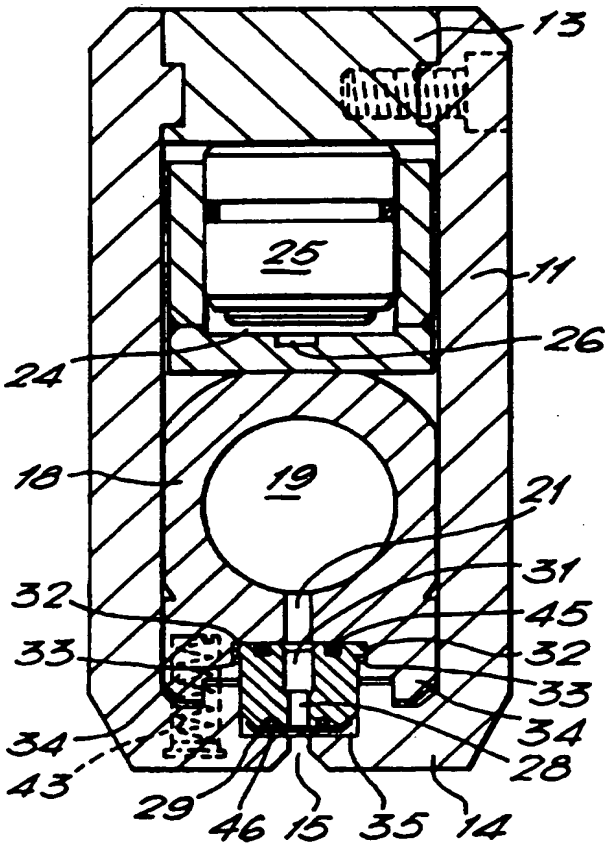
4) Title: APPARATUS FOR JETTING LIQUID ONTO A FIBROUS WEB

7) Abstract

An elongate jet strip (29) for a jetting apparatus (10; 110) for jetting high velocity fluid into a fibrous web, comprising a longitudinally extending flat central portion (41), flanked along each edge by a turned up edge flange (42). The jet strip (41) is used in a jetting apparatus in conjunction with a perforated distribution plate (27).



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Apparatus for Jetting Liquid onto a Fibrous Web

Technical Field

This invention relates to a jetting apparatus for delivering high velocity liquid jets onto a fibrous web for entanglement of the fibres. The invention also relates to an elongate jet strip for use in such a jetting apparatus.

Background Art

Hydraulic entangling methods generally comprise passing a layer of fibrous material on a suitable support surface under high pressure liquid jets supplied from a row or rows of orifices in a jet manifold. Known jetting apparatus as disclosed in US-A-3,403,862 includes a manifold body which receives high pressure liquid to which a jet strip is sealed by rows of bolts. Such jetting arrangements have the disadvantage of requiring prolonged maintenance periods when the jets are to be changed or cleaned due to the large number of bolts to be undone and retightened, and the problems associated with obtaining equal sealing pressures along the jet strip.

In order to overcome the maintenance problems associated with the use of a large number of bolts, it has been proposed in US-A-3,613,999, US-A-4,880,168 and US-A-5,042,722 to provide the jet strips as part of a cartridge unit so that the whole cartridge can be changed as a quick change unit.

A further arrangement is disclosed in EP-A-0,400,249 in which a jet plate is clamped between a longitudinal jaw and a high pressure liquid manifold. The clamping is achieved by means of tie-bars which connect the jaws to hydraulic jacks mounted on the top of the manifold. The jet plate is released simply by removing the clamp load applied by the jacks. Such an arrangement is highly complicated.

Disclosure of Invention

The present invention provides a construction for a jetting apparatus in which the jet strip is clamped in its operational position for easy maintenance.

According to one aspect of the present invention there is provided an elongate jet strip for a jetting apparatus which comprises a substantially flat longitudinally extending central portion flanked along each longitudinally extending edge by a turned-over edge margin.

The longitudinal stiffness of each jet strip is increased by flanking the central portion on each side with a turned-over edge margin. This allows the jet strips to be inserted or withdrawn without danger of creasing or kinking.

Preferably both edge margins are turned-over to the same side of the strip.

According to another aspect of the present invention there is provided a jetting apparatus for delivering high velocity liquid jets onto a fibrous web for entanglement of the fibres and which includes a manifold having a chamber for receiving pressurised liquid and a plurality of outlets for delivering the pressurised liquid to a jet strip according to said one aspect of the present invention, characterised in that an elongate perforated plate is located in the fluid flow path between the manifold and the jet strip so that liquid exiting the manifold passes through the perforated plate.

Preferably the perforated plate has a central elongate chamber which opens towards the jet strip so that the elongate chamber is in communication with the manifold chamber through orifices in the perforated plate.

Conveniently the jet strip and perforated plate extend for at least the full length of the manifold and the jet

strip, perforated plate and manifold are clamped together with the plate and jet strip being removable and insertable longitudinally of the manifold when the manifold is in a non-clamped condition relative to the plate and strip.

Preferably the apparatus further comprises a body having a cavity with the manifold located in the cavity, the manifold being displaceable within the cavity to clamp the perforated plate and jet strip against the base of the cavity. Alternatively the apparatus may include a pair of elongate jaws which serves to clamp the jet strip and perforated plate to the manifold.

According to a further aspect of the present invention there is provided a jetting apparatus for delivering high velocity liquid jets onto a fibrous web for entanglement of the fibres and which comprises a body having a cavity with a manifold located therein, the manifold having a chamber for receiving liquid and a plurality of outlets for delivering the pressurised liquid to a jet strip located in the base of the cavity, characterised in that the manifold is displaceable within the cavity to clamp the jet strip against the base of the cavity.

Preferably the body extends longitudinally and has open end portions at each longitudinal end thereof through which the jet strip can be withdrawn and inserted when the manifold is in a raised, non-clamping condition.

Conveniently the manifold is raised by resilient means biasing the manifold away from the jet strip.

The clamping load on the jet strip is preferably produced by hydraulic actuator means which displace the manifold so as to clamp the strip against the base of the cavity.

Brief Description of Drawings

Embodiments of the invention will now be described, by

way of example only, and with particular reference to the accompanying drawings, in which:-

Figure 1 is a longitudinal sectional view through a first embodiment of jetting apparatus according to the invention,

Figure 2 is a section on the line II-II of Figure 1,

Figure 3 is part cut away isometric view of the apparatus of Figure 1 and Figure 2,

Figure 4 is an enlarged section through a jet strip,

Figure 5 is a cross-section through a second embodiment of jetting apparatus according to the invention, and

Figure 6 is a longitudinal section through the apparatus shown in Figure 5.

Best Modes for Carrying Out the Invention

With reference to Figures 1,2 and 3, there is disclosed a jetting head 10 for an entanglement process in which high velocity water jets are directed onto fibrous material to cause entanglement of the fibres to form a sheet of porous material. Such processes are used in the manufacture of non-woven materials used in medical applications, cleaning, filtration, tea bags etc..

The present invention relates to the jetting head and parts thereof, and a more thorough description of the manufacture of non-woven fabrics using entanglement techniques can be found in US-A-3,485,706.

The jetting head 10 has an elongate hollow substantially rectangular cross-section body 11 having an internal cavity 12 and a typical length of from 3.5 to 4 metres. The upper portion 13 of the body 11 may be separable from the rest of the body 11, being held in place by any suitable means, for

example welding, screws, pins or the like. Although the side and bottom of the body 11 is shown as an integral component, the base portion 14 of the body 11 may also be formed separately and be removably secured to the side portions of the body again by any suitable means such as welding, screws, pins or the like. The base portion 14 of the body is provided with an elongate central slot 15 through which jets of liquid exit the head 10. The longitudinal ends of the body 11 are closed by end plates 16 and 17.

The cavity 12 within the body 11 houses an elongate cylindrical manifold 18 having an internal chamber 19 for receiving jetting liquid, preferably water, at high pressure (in the order of 200-250 bar). The jetting liquid may be fed into one end of the manifold 18 with the other end of the manifold being sealed by a plug (not shown). A plurality of longitudinally spaced apart outlet orifices 21 are located in the lower portion of the manifold away from the ends thereof.

An elongate channel-shaped actuator body 22 is located on the upper surface of the manifold 18. This body 22 may be secured to the manifold 18 by any suitable means or, alternatively, may only be located in a recess 23 formed in the upper outer surface of the manifold 18. The channel-shaped body 22 houses or provides a plurality of longitudinally spaced hydraulic cylinders 24 (extending vertically in Figures 1 and 2) having reciprocable pistons 25 sealingly engaging internal walls of the cylinders 24. For a jetting head 4 m in length there may typically be from 40 to 50 hydraulic cylinders 24 each typically about 50 mm in diameter. The pistons 25 are upwardly displaceable to abut the upper portion 13 of the body 11. The cylinders 24 are supplied with pressurised hydraulic fluid through a slot 26 interconnecting all the cylinders 24.

Below the manifold 18 there is located a perforated distribution plate 27 which has a central elongate chamber

28 which opens downwardly towards a jet strip 29 at the bottom of the plate 27. The chamber 28 is in communication with the chamber 19 by means of longitudinally spaced apart orifices 31 which perforate the distribution plate 27 and which are in registry and in alignment with the orifices 21 in the manifold 18. The orifices 31 have a diameter larger than the transverse width of the chamber 28 to minimise turbulence in use of the apparatus.

The upper portion of the distribution plate 27 has a pair of transversely projecting longitudinally extending shoulders 32 which are accommodated in longitudinally extending grooves 33 in downwardly extending spaced apart lugs 34 on the manifold 18. The lugs 34 locate the distribution plate 27 to the manifold 18. The lower portion of the distribution plate 27 projects into a longitudinally extending recess 35 in the base portion 14 of the body 11. The lower edge margins of the sides of the lower portion of the plate 27 are chamfered for accommodating the jet strip 29, and to facilitate entry into the recess 35.

The jet strip 29 is located in the bottom of the recess 35 and has a plurality of jets therein which align with the chamber 28 on one side and the slot 15 on the other side. The jets may vary in diameter, typically from 80 to 200 microns, and are spaced at intervals of from 0.5 to 1.5 mm centres. In a typical jet strip, about 4 m long, there may be up to 7000 jets per longitudinal row and from one to four, preferably two, rows of jets.

The jet strip 29 is shown in Figure 4 and is conveniently formed from stainless steel and has a length of about 4 m and a thickness of from 1 to 2 mm. In order to stiffen the jet strip longitudinally, the plate is turned up at its edges and thus has a substantially flat central portion 41 flanked on each edge by an inclined or turned over edge margin 42. The two edge margins 42 are inclined or turned over to the same side of the strip and help locate the jet strip 29 relative to the distribution plate 27. The jets 40

are located in a longitudinal central portion 50 which is recessed in both the upper and lower surfaces of the strip 29 so as to protect the edges of the jets as the strips are slid into or out of position.

The manifold 18 is biased away from the jet strip 29 by compression springs 43 located on the base of the cavity 12 between the base portion 14 and the lugs 34.

The manifold 18, distribution plate 27, and jet strip 29 project through apertures 44 formed in the two end plates 16 and 17. The apertures 44 are of such dimensions as to permit vertical displacement of the manifold, plate and strip. The maximum vertical displacement is preferably in the order of from 3 to 4 mm.

In use, hydraulic pressure typically of between from 450 to 500 bar is applied within the hydraulic cylinders 24 which causes the pistons 25 to move upwardly, with the reaction load pushing the manifold 18 downwardly against the biasing of the springs 43 causing the distribution plate 27 to press or clamp the jet strip 29 against the bottom of the cavity 12. Pressurised water (or other jetting liquid) is then fed to the manifold 18 which passes through the orifices 21,31 and chamber 28 to the jet strip 29 and exits the jets in the jet strip at a high velocity.

The distribution plate 27 carries peripheral seals 45 and 46 to seal against the manifold 18 and jet strip 29, respectively.

On release of the hydraulic load in the cylinders 24, the springs 43 push the manifold 18 upwards away from the jet strip 29. The jet strip 29 and/or the distribution plate 27 can be removed longitudinally from the ends of the jetting head 10. If both the jet strip and the perforated distribution plate are removed and inserted as an assembly the jets strip is less liable to damage.

The jet strip 29 may be utilised either way up, that is with the turned over edge margins 42 either cooperating with the chamfered surfaces on the distribution plate or engaging some other locating surface on the base portion 14.

With reference now to Figures 5 and 6, there is shown a second jetting head 110, also in accordance with the present invention, and those components which are substantially identical to components disclosed with reference to Figures 1 to 4 have been assigned the same reference numerals.

The jetting head 110 has a manifold 18 with an internal chamber 19 for receiving the jetting liquid. The chamber 19 has a plurality of orifices 21 passing through its lower sidewall through which liquid under pressure can exit from the chamber 19. Cross-plates 112 and 111 are fixed to the top and bottom of the manifod 18 by, for example, welding, and vertical side plates 113 and 114, and end plates 115 are also fixed together, for example by welding. The manifold 18 and plates 111-115 form a stationary body.

The upper surface 116 of the top cross-plate 112 has a recess 23 therein to receive an elongate actuator member 22 housing a plurality of hydraulic cylinders 24 with pistons 25 vertically reciprocable within the cylinders. The actuator member 22 is encased within the stationary body. Hydraulic fluid is fed to the cylinders 24 by a conduit 117.

The lower surface 118 of the bottom cross-plate 111 and the manifold 18 is machined flat to receive a retainer plate 119 which has a longitudinally extending 'T' shaped slot 121 therein which accommodates a distribution plate 27 and a jet strip 29. The distribution plate 27 and jet strip 29 extend longitudinally beyond one end of the manifold 18 and can be removed or inserted longitudinally of the slot 121. The jet strip 29 has edge margins that are turned up substantially normal to the flat centre portion 41, but they could be turned over, for example, so as to be inclined as in Figure 4.

The distribution plate 27 and jet strip 29 are clamped in position against the manifold 18 by a pair of elongate clamping jaws 122 arranged on the retainer plate 119 to extend one along each edge portion of the jet strip 29 and distribution plate 27 assembly. The elongate jaws are each connected by a plurality of pairs of tie bars 123 passing through the plates 119, 111, 113 on either side of the manifold 18, to respective cross-bars 124 which each seat against a respective piston 25.

The jaws 122 are biassed away from the bottom cross-plate 111 by resilient means, preferably coil springs 125 arranged concentrically with each tie bar and housed in accommodating recesses and holes in the plates 111, 119.

In use hydraulic pressure causes the pistons 25 to move upwardly pushing the cross-bar 124 upwards and therefore through the tie bars 123 causing the clamping jaws 122 to clamp the distributor plate 27 and jet strip 29 to the manifold.

On release of hydraulic pressure the springs 125 push the jaws 22 downwards away from the jet strip 29.

CLAIMS

1. An elongate jet strip (29) for a jetting apparatus comprising a substantially longitudinally extending flat central portion (41) with jet openings (40) therein, characterised in that said flat central portion (41) is flanked along each longitudinally extending edge by a turned over edge margin (42).

2. An elongate jet strip as claimed in claim 1, characterised in that both of said edge margins (42) are turned over towards the same side of the strip.

3. An elongate jet strip as claimed in claim 1 or claim 2, characterised in that jet openings (40) are located in longitudinal recesses in at least one of the upper and lower side surfaces of the said central portion (41) of the jet strip.

4. A jetting apparatus (10) for delivering high velocity liquid jets onto a fibrous web for entanglement of the fibres and which has a manifold (18) having a chamber (19) for receiving pressurised liquid and a plurality of outlets (21) for delivering the pressurised liquid to a jet strip (29) as claimed in any one of claims 1 to 3, characterised in that an elongate perforated plate (27) is located in the fluid flow path between the manifold (18) and the jet strip (29) so that liquid exiting the manifold (18) passes through the perforated plate (27).

5. Apparatus as claimed in claim 4, characterised in that the perforated plate (27) has a central elongate chamber (28) which opens towards the jet strip (29) so that the elongate chamber (28) is in communication with the manifold chamber (19) through orifices (31) in the perforated plate (27).

6. Apparatus as claimed in claim 4 or claim 5,

characterised in that the jet strip (29) and perforated plate (27) extend for at least the full length of the manifold (18) and in that the jet strip (29), perforated plate (27) and manifold (18) are clamped together with the plate (27) and jet strip (29) being removable and insertable longitudinally of the manifold (18) when the manifold is in a non-clamping condition relative to plate and strip.

7. Apparatus as claimed in any one of claims 4 to 6, characterised in that the apparatus further comprises a body (11) having a cavity (12) which the manifold (18) is located, the manifold being displaceable within the cavity to clamp the perforated plate (27) and jet strip (29) against the base of the cavity.

8. Apparatus as claimed in any one of claims 3 to 6, characterised in that there is further provided a pair of elongate jaws (122) which serves to clamp the jet strip (29) and perforated plate (27) to the manifold (18).

9. Apparatus as claimed in claim 7 or claim 8, characterised in that hydraulic actuator means (24,25) are provided to clamp the jet strip (29) and perforated plate (27) to the manifold (18).

10. Apparatus as claimed in claim 9 when dependent upon claim 6, characterised in that the hydraulic actuator means comprises a plurality of hydraulic cylinders (24) located between the manifold and an upper portion of the body so that operation of the hydraulic cylinders causes movement of the manifold to clamp the jet against the base of the cavity.

11. Apparatus as claimed in claim 9 when dependent upon claim 8, characterised in that the hydraulic actuator comprises a plurality of hydraulic cylinders (24) located on the side of the manifold away from the jet strip, the cylinders operating tie-bar means (123) bridging the manifold and connected to the jaws (122) whereby movement of

the piston may be transferred to the jaws.

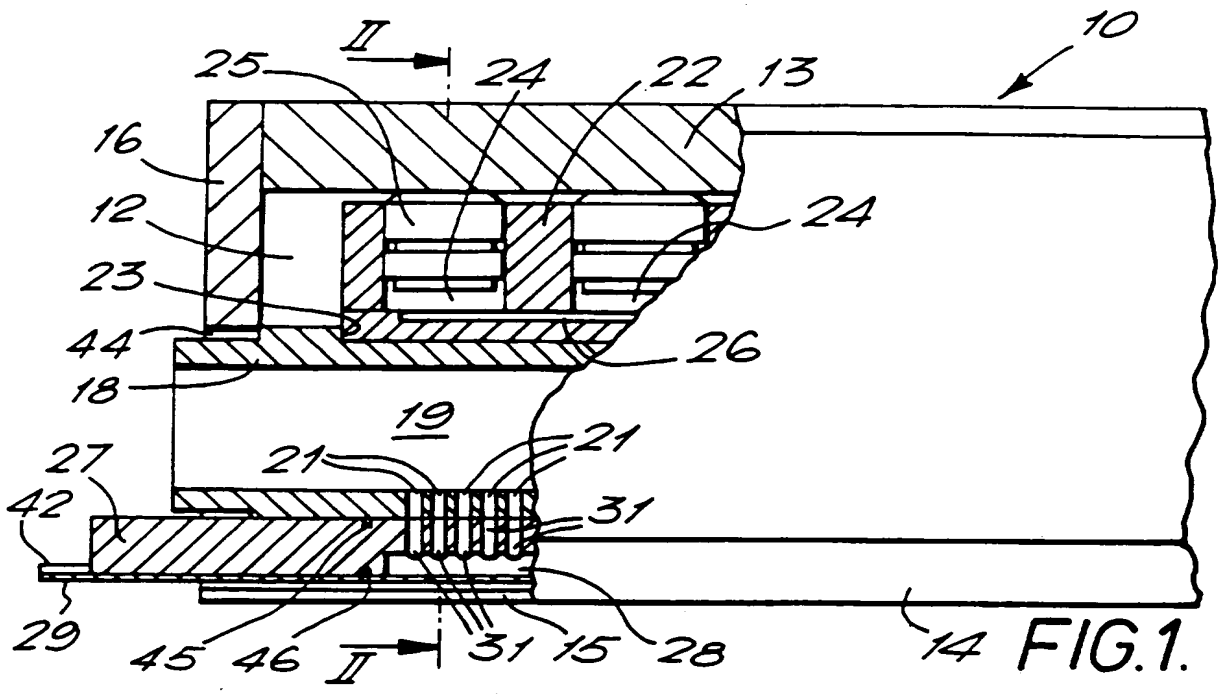


FIG.1.

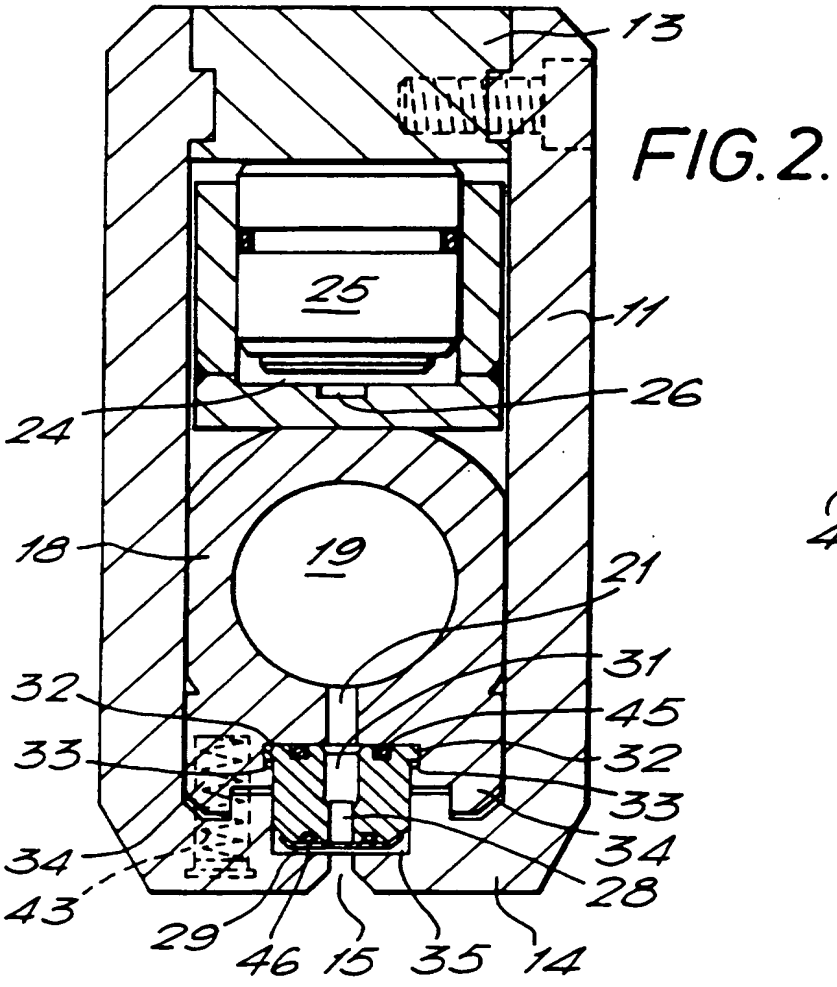


FIG.2.

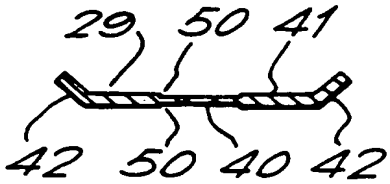


FIG.4.

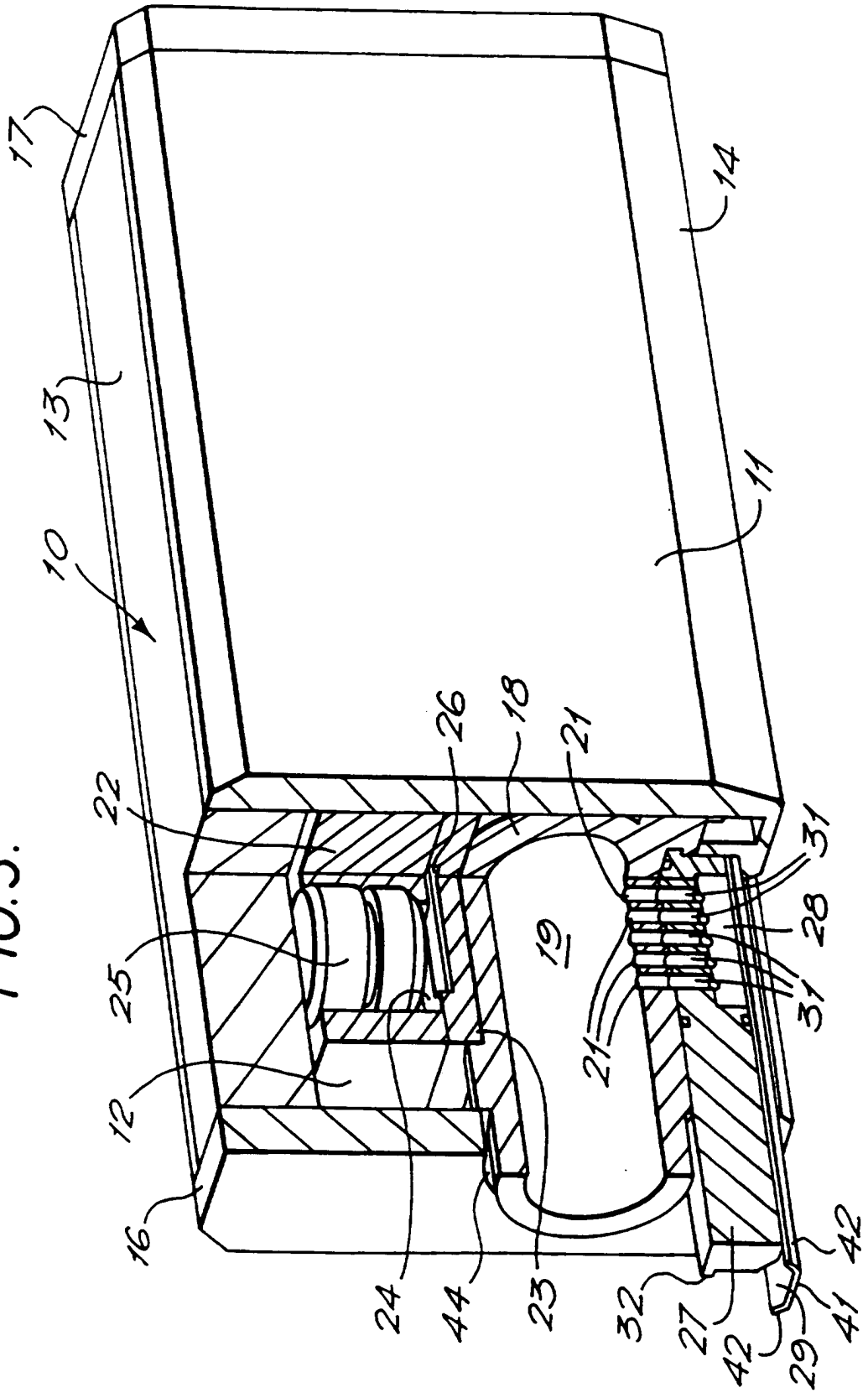


FIG.3.

FIG.5.

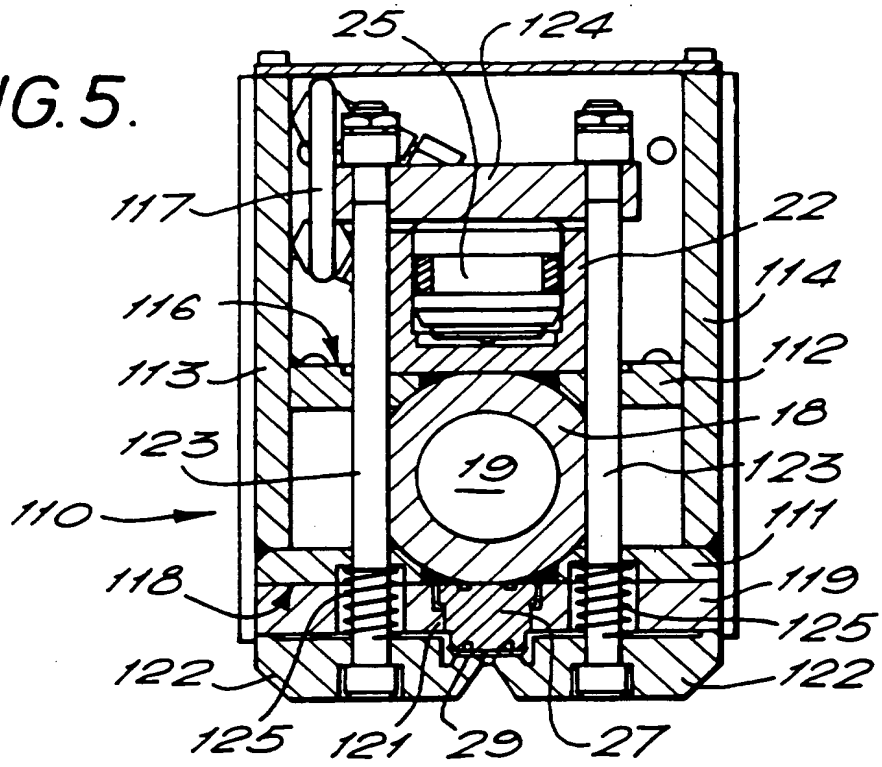
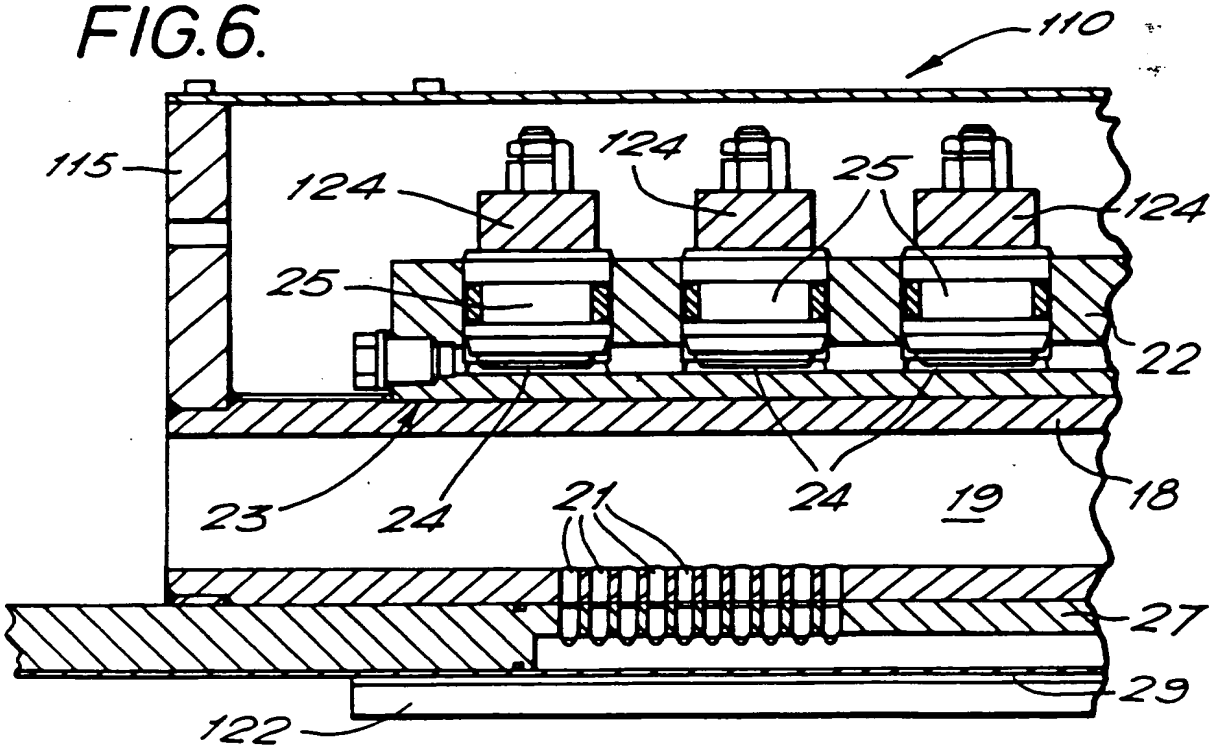


FIG.6.



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A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 D04H1/44

According to International Patent Classification (IPC) or to both national classification and IPC

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Minimum documentation searched (classification system followed by classification symbols)
IPC 6 D04H B26F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A,3 613 999 (BENTLEY THOMAS P ET AL) 19 October 1971 cited in the application see whole document	1-4,6
A	US,A,5 054 349 (VUILLAUME ANDRE) 8 October 1991 cited in the application see whole document	1,6-11
A	GB,A,2 237 824 (HONEYCOMB SYSTEMS) 15 May 1991 see page 4, line 6 - page 16, line 4; figure 3	1-6
A	US,A,3 508 308 (BUNTING ET AL.) 28 April 1970 see column 10, line 27 - line 52; figure 9	1

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European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl,
Fax (+ 31-70) 340-3016

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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US-A-3613999	19-10-71	NONE		
US-A-5054349	08-10-91	NONE		
GB-A-2237824	15-05-91	US-A-	5042722	27-08-91
		DE-A-	4012541	20-06-91
US-A-3508308	28-04-70	NL-A-	6717426	24-06-69